DR. BALFOUR STEWART'S METEOROLOGICAL BLOCKADE

IMAGINE a line drawn round any district, and consider all the air that passes over that line outwards and inwards in any time. Let the whole quantity of vapour of water carried across the boundary line by this air be determined. If during any particular interval of time there is just as much vapour carried outwards as inwards, there must be in that interval either no rainfall on, and no evaporation from the district, or there must be just as much rainfall as evaporation. If more vapour is carried out than in, there must be more evaporation than rainfall. Or, if more vapour enters than leaves, the difference falls in excess of rain above evaporation.

Dr. Stewart proposes to establish a *cordon* of meteorological stations, and to arrange a reduction of observations taken at them, so as to keep, as far as possible, an exact account of the quantity of vapour entering and leaving the space over the surrounded district. This appears to me a most valuable proposal, which, if well carried out, must have a very important influence, tending to raise meteorology from its present empirical condition to the rank of a science. The object of the present notice is to suggest that the same system of account-keeping ought to be applied to electricity.

Whatever we may think as to the nature of electricity, it certainly has, in common with true matter, the property of being invariable in quantity. This property is conveniently enough expressed, as it were, mechanically, by the one-fluid hypothesis, which asserts that positive or negative electrification of any piece of matter consists in the presence of more or less than a certain quantum of the electric fluid; that quantum being the amount possessed when the matter in question exercises no attractive or repulsive force, varying with artificial variations of the electric condition of the testing body presented to it. On this hypothesis, "quantities of electricity," positive and negative, are excesses of the quantity of the hypothetical fluid above or below the "quantum" corresponding to zero of the electric tests.

The ordinary fair-weather condition in our latitudes presents us with negatively electrified air in the lowest stratum, extending at least as high as our ordinary houses above the surface of the earth; and positive electricity of greater amount, on the whole, in the higher regions. The atmospheric electrometer indicates in absolute electrostatic units the total quantity of electricity in the atmosphere, over a certain area of the place of observation; being the excess of the amount of positive above the amount of negative electricity in the whole column. This excess in fair weather is generally positive. The fact that it is not the electricity in the lower regions alone, but an effect depending on the whole electricity of the atmosphere from lowest to highest, that is the thing observed in the ordinary observation of atmospheric electricity, renders this subject more suitable even than moisture for the application of Dr. Stewart's blockade. Thus, the hygrometrical blockade is complete only if both moisture and the effective component of wind are known at all heights above the surface; the electrical blockade is complete when, besides the electrometer measurements at the observatory, the effective component of the wind at all heights is known. But among the many unknown quantities involved, the two departments of the blockade combined will give means for eliminating some and estimating others for which the hygrometrical blockade alone, or the electrical one alone, would be insufficient.

WILLIAM THOMSON

THE SCENERY OF ENGLAND AND WALES

The Scenery of England and Wales, its Character and Origin. By D. Mackintosh. (Longmans and Co.)

READERS of some of the geological journals are sufficiently acquainted with the name of Mr. Mackintosh. They know him as a writer who, for the last four or five years, with wonderful perseverance, has kept on enunciating certain views of denudation which he has adopted. His papers, however, do not suggest that their author possesses the large grasp of the subject, the range of acquirement in geological studies, and the gifts of style which must necessarily belong to the man who would successfully expound the history of the scenery of the country. The task is a difficult one—much more difficult than even geologists themselves usually believe—and the announcement that it had been undertaken by Mr. Mackintosh probably took a good many readers by surprise. They could not but award him the credit of great boldness, whether or not they found, on examination, that he deserved also the praise of success.

Mr. Mackintosh, as a writer on geological subjects, is under the influence of one dominant idea. He believes in the Sea, the whole Sea, and nothing but the Sea. It seems to haunt him like a nightmare. To his ear all sounds in Nature are drowned in the thunder of waves, the rush of ocean-currents, the beating of multitudinous billows, that batter and grind the solid substance of the land. A mist of ocean spray is ever in his eyes. He can but dimly see that any other powers are at work around him save the everlasting breakers. The fall of rain, the roar of rivers, the silent majesty of glaciers and snowfields, have little charm for him, and can never wean his affections from his first love. He can be brought to turn his thoughts neither to the right hand nor to the left, but keeps his eye stedfastly fixed on the one grand object of his faith and adoration. If, indeed, for a moment the contending claims of some other power in Nature obtrude too pertinaciously upon his notice, he clings to some bigger wave, or dashes into some stronger ocean-current until the temptation has passed away.

It is seldom that we meet with one governing idea so unflinchingly followed to the exclusion of anything and everything which might modify it; seldom that we encounter mental colour-blindness so thorough as to admit of the discrimination of apparently but one hue. Not merely does he everywhere and always reiterate that "the greater part of the land surface, at any given time, must present the form given to it by the sea," but he traces this marine sculpturing down to the minutest details of contour, even though rains and frosts and streams seem to rise up in protest to his face. The tendency unduly to exalt the power of the sea as a geological agent has always characterised the writings of English geologists, probably from the greater prominence which the sea acquires in the eyes of islanders. But the tendency never received such an extreme development as it has done in Mr.

Mackintosh's pages. He complacently remarks that his views "more or less agree with opinions held by Sir R. I. Murchison, Sir Charles Lyell, Professor Phillips, Mr. C. Darwin, and others. This *argumentum ad hominem*, we imagine, will hardly be relished by some at least of these gentlemen. Mr. Mackintosh should remember that if his views are sound, the citation of such names is not necessary, while, if they are erroneous, not all the big names in England can save them from the oblivion to which they are doomed.

The author of this volume has evidently never travelled. He tells us, too, that he purposely refrained from reading until his views were formed, "lest a bias should be given to his opinions." And his reading, since these unbiassed opinions were elaborated, appears to have consisted mainly of the recent journals and magazines in which he himself has been writing. And yet a man without travel, and without reading, sits down to write a book on the character and origin of the scenery of a country! He has taken his own little corner of the earth and framed his theory out of it, forgetful of the wide world outside, which must be studied as a whole, if one would well understand any part. While reading the book with laudable perseverance, we have had four lines of "Don Juan" constantly suggesting themselves, where the poet describes a certain easy-minded old gentleman as one who

> "Saw with his own eyes the moon was round,
> Was also certain that the earth was square,
> Because he had journeyed fifty miles and found
> No sign that it was circular anywhere."

We presume that Mr. Mackintosh's views would "more or less agree" with those of this philosopher as to the shape of the moon, and generally as to matters of fact regarding which there can be no dispute. Like the same worthy, too, he does not take things on trust. He uses his own eyes and draws his own inferences. He is certain of his convictions, because he has journeyed so many miles and found no sign that these convictions could be anything but true. Unfortunately, however, he has either made his journeys with a foregone conclusion in his mind, or they have been too limited to enable him fully to understand what the subject really is of which he proposes to treat; or, what is probably the truth, he lacks that grounding in exact knowledge of geological structure which is absolutely necessary to one who wishes to elucidate the history of a land surface.

So much for the general purpose of the volume. Its plan and execution are sadly unmethodical. It is divided into three books; but, in spite of the explanation of this arrangement given in the preface, it is not easy to trace any clear distinction in the subjects of the divisions. The reader is jerked from one topic to another, getting of some of them the merest glimpse, so that after a little he begins to experience something of the feeling of unrest which comes over him at another time when he tries to pick out the details of a landscape from the window of an express train. There is no index to the book, and unless a passage is specially noted down at the time of perusal its subsequent recovery is troublesome. Altogether the volume suggests to the reader the idea that he has here a multifarious collection of jottings and excerpts from note-books, strung together with not much reference to their connection. For example, the First Book, according to the table of contents, consists of "Introductory remarks on the causes of denudation and origin of natural scenery in various parts of the world." Under this comprehensive title come just twenty-one pages, in which a word or two are said about faults and fractures, the fact that rains, frosts, rivers, and glaciers are denuding agents is alluded to and not denied, while about fourteen pages, or two-thirds of Book I., are devoted to desultory remarks on sea-bottoms, Irish eskers, oceanic currents, waves in Norway, waves in Shetland and Caithness, waves on the coast of Ireland, sea escarpments in Ireland, remarks on Irish cliffs, sea-coast cwms in Ireland, beachless shores, denudation of Norway, denudation of South America and Australia. This introduction is really a very fitting one to the rest of the book. It shows how the hue of the author's spectacles not only colours all his own observations, but will not let him see the true tint of the observations of other people. For instance, he professes to condense from Forbes's work an "account of the most striking physical features of Norway, *excepting those resulting from glacial action.*" *Hamlet* with the Prince of Denmark omitted was nothing to this. If there is one country in the world more marvellously eloquent of glacial action than other countries it is Norway. That is the one grand physical feature of the peninsula; every fjord, every fjeld points to the grinding power of ice. Yet a writer on denudation, anxious as to the impartiality of his views, ventures to write about the sculpturing of the present physical features of Norway, and to pass the glaciers and snowfields by. Again, he cites Australia as a recently emerged area, where there cannot have been any "long-continued action of rains and streams." But he takes no note of the old river gravels, with cappings of basalt, hundreds of feet above the level of the present streams, which point to the passage of a vastly protracted period of subaërial erosion.

Perhaps no passage in the book shows better the author's obliquity of vision, and his consequent (though no doubt unintentional) unfairness, than one in this same introductory chapter, where, in lieu of giving the reader a general view of what denudation is, he states, on the authority of Mrs. Somerville, that a tidal current in the Shetlands runs at the rate of fifteen miles an hour, while "*the average velocity of the river Rhone is not a mile and a half an hour.*" No one unacquainted with the subject would be likely to escape the inference which the writer probably intended should be drawn, that even a rapid river like the Rhone has not more than a tenth of the erosive power of some marine currents. Now, though there can be no doubt that some of the most rapid currents known flow among the Orkney and Shetland Islands, yet we take leave to question whether any of them ever reach by any means so high a velocity as fifteen miles an hour. Yet even granting that they do, they are quite exceptional, and it was long ago shown by Dr. Fleming that their erosive power over a surface of rock is nearly, if not wholly, *nil*, for they cannot even rub off the crust of tender barnacles. But to set down the average velocity of the Rhone as "not a mile and a half an hour!" Shade of old Rhodanus! have mercy upon Mr. D. Mackintosh if that gentleman ever gets near enough the "rushing of the arrowy Rhone." A mile and a half an hour! why, that is a very feeble velocity for most of our comparatively sluggish British rivers. The Thames flows at the rate of two or three miles an hour, the Severn at three or four miles, and most of our upland streams run still faster. Surely there is just cause of complaint against a writer who, in support of a theory which he has adopted, cites facts which are wholly exceptional without saying that they are so, while at the same time he is led in his ardour unconsciously to misstate the facts which do not tell in his favour.

We have read this book with a feeling of regret that it should ever have been published. Its author is evidently a hard-working observer, and perhaps had he been less ambitious, and been content to wait some years longer until his experience had widened, and he had found time to mature and methodise his opinions, our verdict upon his labours might have been different. As it is, he has hastened before the world with a book of which, in a year or two hence, no one will see the crudity more keenly than he will do himself. A work which aims at giving a popular version of any branch of scientific inquiry should be eminently clear, accurate, and readable. Mr. Mackintosh's volume fulfils none of these conditions, and we only fear that its effect may be to discourage readers from seeking to learn more of what is in reality one of the most fascinating fields of geology.

OUR BOOK SHELF

Medical Chemistry. — *Manuel de Chimie Médicale et Pharmaceutique.* Par Alfred Riche. 8vo., pp. 771, figures 104. (Paris : Germer-Baillière, 1870. London : Williams and Norgate.)

WE have here a comprehensive text-book of chemistry, in which the medical and pharmaceutical applications of the science are specially noticed. The author is one of the professors in the School of Pharmacy at Paris, and the "mineral chemistry" of the manual is essentially a reproduction of his course of lectures. The "organic chemistry" is based on the course of Professor Berthelot, and the toxicological portions of the work reflect the teaching of Professor Bouis. Though designed for the use of students of medicine and pharmacy, this manual is primarily a systematic exposition of the fundamental facts of chemistry, and its technical character is revealed only in incidental explanations. Thus, sulphuric acid is noticed with the oxygenated sulphur compounds, and its properties, preparation, commercial manufacture, purification, and chemical constitution, receive adequate treatment before its medical employment and its action as an irritant poison are considered. Again, in the section on the natural alkaloïds we get the chemical history of each of the more important opium bases before we obtain any information respecting the assay of opium, the action of the drug on the human system, or the symptoms of poisoning by opiates. The officinal processes for preparing the chemical substances used in medicine are plainly but briefly described, and practical directions are given for testing the purity and estimating the strength of commercial products. The author has devoted 150 pages to "biological chemistry," an important section of the science which receives scant notice in most manuals, and has minutely described methods of analysing milk, blood, urine, and calculi, which may be adopted by the physician to obtain trustworthy indications of the progress of disease or the effects of medicines. Professor Riche's manual has so many good qualities that we reluctantly call attention to a characteristic which detracts from its value as a treatise on general chemistry. While admitting that the modern or molecular notation is preferable to the notation based on the old equivalents, the author deliberately rejects the former "because it is not yet recognised in the official programmes." Consequently, the book is filled with symbolic formulæ which do not accord with accepted theories. In the introduction to the "organic chemistry," M. Riche attempts to adapt the exoteric notation of his school to modern ideas by doubling the symbols of oxygen, sulphur, and carbon ; but English students will look with little favour on the hybrid formulæ thus produced. We trust that the author will burst his bonds of red tape before the second edition of his manual is issued. J. C. B.

Heads and Tales ; or, Anecdotes and Stories of Quadrupeds and other Beasts, chiefly connected with Incidents in the Histories of more or less Distinguished Men. By Adam White, late Assistant in the Zoological Department, British Museum. (London : Nisbet and Co. 1870.)

THE idea of bringing together the anecdotes of animals recorded in the biographies of great or well-known men is a good one ; but the notion of interlarding these anecdotes with facetiæ selected chiefly from Mr. Mark Lemon's "Jest Book" can hardly be commended. Mr. White is sadly mistaken if he supposes that well-written stories of animal life require to be made palatable to school-boys by the addition of puns and shallow witticisms. Schoolboys may well be amused at the solemn way in which the author announces his discovery (in the pages of Macaulay) of the cause of the death of William III. ; but they will think it beyond a jest when they themselves discover that six pages which should have been filled with anecdotes are occupied by Macaulay's account of the last days of King William. Mr. White does not exclude man from what he is pleased to term his anecdotical treatment of the great order Mammalia. Three stories of a ludicrous character, however, suffice to illustrate the human species. The schoolboy reader is duly warned against the theory of the genesis of man by natural causes in the following terms :—"Let us never for a moment rest in such fallacious theories, or accept the belief of Darwin and Huxley, with a few active, agitating disciples, that animals, and even plants, may pass into each other. Darwin and Huxley cannot change nature. They may change their minds and opinions, as their fathers did before them. It is, we expect, only the old heathen materialism cropping out." This extract is, perhaps, sufficient to show the author's mental calibre. It is not necessary to praise the illustrations of this book ; it is quite sufficient to mention that they are from the drawings of J. Wolf.

Facts and Dates ; or, The Leading Events in Sacred and Profane History, and the Principal Facts in the various Physical Sciences : the memory being aided throughout by a simple and natural method. By the Rev. Alex. Mackay, LL.D. (Blackwood and Sons.)

A SO-CALLED system of mnemonics may possibly be of use to young men cramming history and geography for competitive examinations ; but we see no room for it in science-teaching. The scientific facts capable of being expressed by numbers, and which it is desirable to commit to memory, are really very few. Indeed, we believe they are so few in any given science, that it would take most people longer to master Dr. Mackay's system of artificial memory than to learn the numbers themselves. The author has spent a good deal of labour in so framing his mnemonic sentences as to contain ideas having some connection with the fact intended to be remembered. This is all very well ; but the essential fault of his system, and of every such system, is, that it is not sufficient to remember the *idea* contained in the mnemonic sentence : every word of it must be accurately retained. We are sorry to see that Dr. Mackay is sadly afflicted with the Great Pyramid craze. The introduction of such a matter as the pretended scientific revelation into a book intended for school use is very much to be deprecated.